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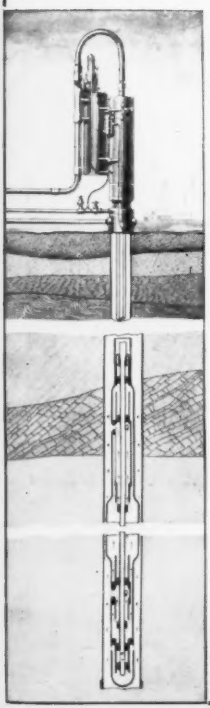

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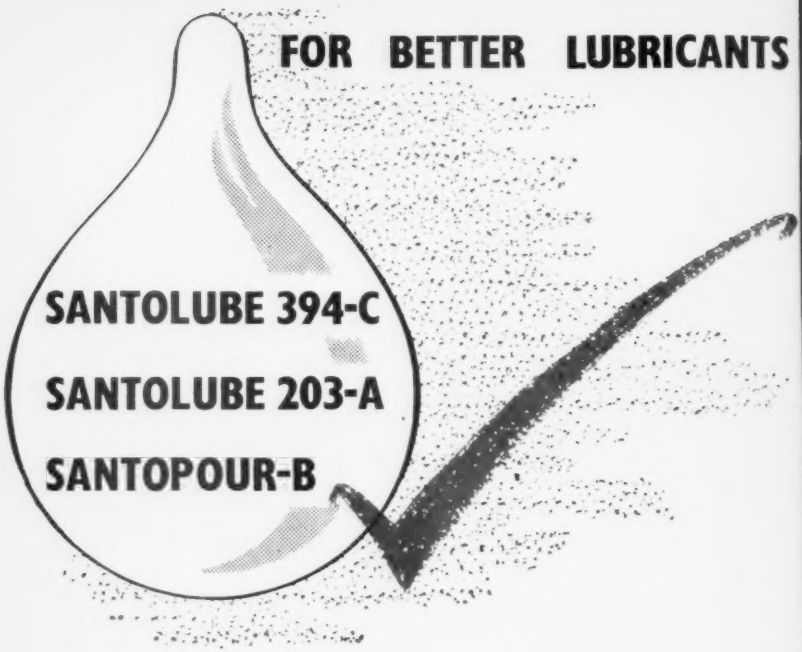

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THE EUROPEAN RECOVERY PROGRAMME AND THE FUTURE OF OIL IN WESTERN EUROPE

By J. D. E. RHODES

AT the end of last December the Organization for European Economic Co-operation (O.E.E.C.) submitted to the Economic Co-operation Administration (E.C.A.) in Washington a report* which is of particular interest to those engaged in the petroleum industry. It was concerned with the co-ordination of the programmes to be followed by the nineteen participating nations in their effort to achieve economic independence by 1952–3. The discussions arising out of the report are still continuing and finality may not be reached for some time. This article will examine the content of the proposals affecting petroleum.

The objective of the O.E.E.C. is to balance western European accounts with the western hemisphere by 1952–3. It is recognized that this will be no simple task; indeed, it is frankly stated that, if the programme for imports is adhered to, there will be a deficit of over a $1000 million in trading with the western hemisphere and an overall deficit equivalent to $800 million in 1952–3.

(*Thousand million dollars at* 1948 *prices*)

	Imports	*Exports*	*Invisible Income*	*Balance*
North and Central America	3·8	2·1		
South America	2·1	2·0		
Sterling area	3·3	3·1		
Eastern Europe	2·2	2·0		
Other countries	1·4	1·4		
	12·8	10·6	1·4	0·8

THE ORIGINS OF THE DOLLAR SHORTAGE

The problems which confront the O.E.E.C. have their roots deep-seated in recent history. During the second half of the nineteenth century and up to 1914, western Europe as a whole enjoyed the advantages of being the leading, if not the only, group of manufacturing countries in the world, and they

* "Interim Report on the European Recovery Programme", (2 vols.), Paris, December 30, 1948.

possessed capacities in excess of their own needs. Most countries, including even the U.S., looked to western Europe for both the capital and the goods required for their economic development. Thus, before the 1914–18 war, western Europe enjoyed a substantial export surplus—a surplus which was largely financed by the investment of European capital overseas.

Economic development in the U.S. towards the end of the nineteenth century and in the early part of this century served to prepare the U.S. for its role as the main supplier of munitions, food, and raw materials to the Allied Forces during the 1914–18 war. These supplies were mainly purchased through loans extended by the U.S. to the Allies, with the result that the U.S. emerged from the war as a creditor nation for the first time in its history. Generally speaking, until the early thirties, western Europe succeeded in making the payments required to service and repay these loans, but the flow of gold involved gradually induced most countries to declare themselves unable to continue to bear the burden. This merely signified that the dollar shortage, of which we are now so much aware, had begun to take effect. It remained latent during the years preceding the second world war, however, mainly because the volume of world trade was sufficient to enable most countries to continue trading on the nineteenth-century multilateral pattern, which, aided by private loans and investments from the U.S., reduced the flow of gold from western Europe to the western hemisphere to a manageable proportion.

The Post-1939 War Situation

The recent war destroyed the multilateral trading pattern and brought the dollar shortage into the forefront of world economic events. War destruction has at once reduced western Europe's ability to earn dollars on its own account and, at the same time, has increased its dependence on the western hemisphere for supplies of food and raw materials.

Until April 1948, Europe's problems were dealt with on an *ad hoc* basis. Large and persistent trading deficits with the dollar area were reduced, in certain cases, by restricting purchases to the minimum consistent with an adequate, if austere, standard of living. Nevertheless there were certain essential dollar payments and these were met in various ways—from reserves, by purchases of dollars from the International Monetary Fund, by borrowing from the International Bank for Reconstruction and Development, and last, but not least, by dollar aid in the form of loans and grants from the U.S. itself.

Mr Marshall's historic offer in June 1947, from which the European Recovery Programme has evolved, will go down in history as an act of statesmanship of the highest order. The Marshall Plan is a recognition that, as a creditor nation, the U.S. has responsibilities and duties, which include the obligation to give systematic aid to enable western Europe to achieve recovery, and so to establish conditions in which international trading can once again flourish. Although it is still doubtful whether these objectives will be reached, considerable progress towards them has already been made. The third report of the Economic Co-operation Administration to the U.S. Congress indicates that attainment of the production and trade goals of the E.R.P. countries for the year ending June 30, 1949, is virtually assured and estimates that the aggregate gold and dollar deficit of these countries for the year will be 30 per cent less than their 1947 deficit of $7800 million.

Petroleum and the European Recovery Programme

From Tables I, II, and III the general aim of the programme as it affects petroleum is at once apparent. Imports of crude oil are to replace, to a large

extent, those of finished products with a consequent saving of foreign exchange, and are to come increasingly from non-dollar sources to help restore a trading balance between the O.E.E.C. countries and the western hemisphere.

TABLE I
IMPORTS OF CRUDE OIL AND OIL PRODUCTS

	1948–9	1949–50	1952–3
Quantity	*Thousand metric tons*		
Crude oil ..	20,213	26,089	57,485
Oil products ..	29,528	27,408	18,615
Total	49,741	53,497	76,100
Value	*Million dollars*		
Crude oil ..	347	435	901
Oil products ..	983	932	683
Total	1,330	1,367	1,584

TABLE II
IMPORTS OF CRUDE OIL AND OIL PRODUCTS
FROM DOLLAR AND NON-DOLLAR SOURCES, INCLUDING IMPORTS FROM NON-MEMBERS

	1948–9	1949–50	1952–3
Crude oil		*Million dollars*	
Dollar sources ..	159	184	332
Other sources ..	188	251	569
% from dollar sources ..	46	42	37
Oil products			
Dollar sources ..	532	468	356
Other sources ..	451	464	327
% from dollar sources.. ..	54	50	52

TABLE III
CONSUMPTION OF OIL PRODUCTS

	Million metric tons
1948–9	47·0
1949–50	49·7
1952–3	62·4

Outline of the Programme

During the first year of the plan, 1948–9, imports of crude and products are estimated at 49·7 million metric tons, costing approximately the equivalent of $1330 million. About half of this expenditure will be incurred in dollars, of which some $530 million will be accounted for by funds set aside for this purpose by the E.C.A. By far the largest part of this dollar allocation will be needed to cover the exchange requirements represented by the European trade of American companies. The E.C.A. share of expenditure in petroleum represents some 11 per cent of the total amount of aid to be made available during the year 1948–9. Apart from food and machinery, petroleum is the largest single item by value on the import programme.

In the following year, 1949–50, imports of crude are scheduled to be some 6 million metric tons higher than in 1948–9, while imports of refined products will fall by 2 million metric tons.

Oil represents the largest single item, after food, on the 1949–50 import programme. By value, 40 per cent of crude oil imports and 50 per cent of refined products will come from dollar sources, as against 46 and 54 per cent respectively in 1948–9, but it is not possible at this stage to say what proportion of this dollar expenditure will be financed from E.C.A. funds. Discussion is now taking place in Washington on the allocation of dollars to be made for the whole programme.

Implications of the Programme

In 1952–3 it is anticipated that imports of crude oil will have risen to 57·5 million tons, of which only just over a third will come from dollar sources, while product imports will be down to 18·6 million tons.

Consumption of oil products in 1952–3 is given at 62·4 million metric tons. At first sight this makes the import of 76·1 million metric tons of products and crude seem disproportionately large. Since 18·6 million metric tons are to be imported as products, it seems clear that even allowing for refinery uses, losses, and working stocks of crude, there is likely to be a small excess of products for export. Certain countries, including France, Italy, and the U.K., may have some products available for export; it would be interesting to know where these exports will go and in what currency they will be paid for, but no indication of this is given in the report. The preponderance of crude imports

which it is proposed to achieve by the end of the programme will only be possible if the participating nations succeed in carrying through their plans for the erection of refineries to process the additional supplies.

The tables reflect the part which the greatly increased refinery capacity of western Europe is designed to play in saving foreign exchange by the substitution to an increasing extent of crude imports for imports of finished products. The saving in foreign exchange which will result from this policy has been estimated to be the equivalent of $500 million. This policy, however, raises problems which are fundamental to the petroleum industry and which are now presumably being discussed by the O.E.E.C. and the E.C.A.

At the present time, refinery capacity in western Europe is approximately 24 million metric tons. If the tentative plans prepared by the individual countries separately were implemented, total capacity by 1952–3 would be round about 65 million tons; however, it is likely that the figure which ultimately emerges from the present discussions will be less than this. In the U.S. this great programme of expansion has given rise to fears that the international pattern of the oil trade will suffer drastic changes and that the operations of American companies will be limited in markets in which traditionally they have held large interests. It has also been suggested that dollar products, excluded from western Europe, would of necessity flow to other markets and make it all the more difficult for European-controlled companies to play their part in maintaining and increasing foreign exchange, particularly hard currency earnings.

Those, therefore, who are called upon to pronounce finally upon the programme have difficult decisions to make, involving a nice calculation of short-term and long-term advantages or disadvantages.

It does not appear to be seriously in doubt that adequate supplies of crude oil for the greatly increased refining capacity of the European countries will be available, and in all probability there will be sufficient steel to meet the equipments needs of the programme. What is less certain is the ability of the participating nations to pay. Looking at Table II, expenditure in dollars in 1948–9 is estimated at $691 millions, against $688 millions in 1952–3. Although, owing to the substitution of crude oil for finished products, the cost per ton of petroleum imported from dollar sources will have greatly diminished in the latter year, total dollar expenditure will remain about the same. To be able to meet this large item on the import bill, the O.E.E.C. nations will need to spend some 17 per cent of their total earnings. If dollar earnings do not come up to expectations, petroleum might be one of the commodities on which economies would have to be made and the reduced consumption which would correspond with economies in this direction would involve a failure to achieve the higher standards of living which it is hoped to reach in western Europe by the end of the five-year plan.

An additional reason for caution is to be found in the fact that included in the individual plans of the nineteen countries are a certain number of projects for small-scale refineries designed to cater for the needs of limited local markets, and that the operating costs of such refineries tend to be relatively high.

From the petroleum point of view, therefore, many problems remain. Pressing though the need to conserve dollars may be for the E.R.P. participants, little is to be gained by pursuing policies which, in the long run, may mean dearer products for the European consumer. Indeed, since petroleum products are often basic to the production of other goods for export, higher production costs could

conceivably seriously reduce foreign exchange earnings over a wide field.

While a reduction of the extent of European dependence on petroleum imports from the dollar area is an essential part of the European Recovery Programme, it is vitally important to avoid raising production costs unduly in the pursuit of this end. To do so would help to perpetuate the division of the world into self-contained trade and currency areas and have an adverse influence on the long-term possibilities of world economic progress.

THE THIRD WORLD PETROLEUM CONGRESS

The third World Petroleum Congress will be held in the Netherlands during May or June 1951. The first Congress was held in London in 1933, and the second in Paris in 1937. The third Congress will be organized by the Petroleum Section of the Netherlands Royal Institute of Engineers.

The secretariat is established at 30, Carel van Bylandtlaan, The Hague, to which address the names of those who propose to attend the Congress should be sent. A circular giving full particulars will be forwarded to interested parties in due course. The Congress will last one week. It has been decided that French and English shall be the official languages.

The purpose of the Congress is to provide an opportunity for the scientific discussion of all technical subjects appertaining to the petroleum industry or allied to it. These scientific discussions will be of a high standard, as it is to be expected that the Congress will be attended by representatives of all branches of the petroleum industry throughout the world. The results of this Congress will, therefore, undoubtedly be of great importance for the petroleum industry as a whole.

MALARIA CONTROL IN TRINIDAD

A successful war on the malaria-carrying mosquito has been waged by Shell at their Port Fortin oilfield. During the past seven years the malaria-control measures undertaken at this oilfield in the south-west of Trinidad have reduced the incidence among field workers and administrative staff from 8·3 per cent (255 among 3000 employees) in 1941 to 0·3 (12 out of 4000) in 1948.

Malaria is caused by a small parasite which lives in the bloodcells of an infected person. The disease is carried through the bite of the female Anopheles mosquito, and thus the most effective way of controlling malaria is to destroy this mosquito.

Control may take the form of preventing the accumulation of still water, where the mosquito breeds, or of killing the larva and pupa in the development of the insect before it emerges into the adult—and dangerous—stage.

At Port Fortin the first attempts at anti-malarial control were made in a limited area in 1941. These included the dusting of swamps with Paris Green and the oiling of open waters to kill the larvae.

This was followed by a more comprehensive system consisting of routine surveys for the detection of larvae and the location of breeding areas, and of clearing and drainage operations. The area under control was gradually extended and a main drainage system constructed.

These measures soon produced satisfactory results. Year by year, the number of recorded cases dropped—253, 202, 161, and 126 in the years 1942–5 inclusive. In 1946 there was a sharp fall to 19 and last year there were only 12.

Improvements in staff housing, planning and control have also played their part, while much experimental work has been carried on in connexion with the development of better larvicides.

PETROLEUM IN PARLIAMENT

Used Lubricating Oil

The Parliamentary Secretary to the Ministry of Fuel and Power said, on June 27, that advice on salvage and recovery was given re-refiners of used lubricating oil by Board of Trade officers. When necessary they placed the industrialist in touch with re-refiners.

Leeward Islands

The question of underwater boring along the coast of the Leeward Islands was once more raised on June 29. The Secretary of State for the Colonies said that no geological survey of the islands had been or is as yet being carried out. The Governor had been in touch with the British Guiana Geological Survey, and the situation in the islands would be related to other geological work to be done in the region.

He had been advised that it was unlikely that the geological structure of the islands was favourable for the accumulation of oil.

Overseas Mining Allowances

In the discussion on annual depreciation allowances for overseas mining companies in the committee stage of the Finance Bill on June 23, Mr Errol said:

"A more striking case can be found in the oilfields, particularly in the Persian Gulf regions, which were desolate until the works were established. The land rapidly acquires a new value, thanks to the enterprise of Arab merchants not hindered or fettered by a Town and Country Planning Act, or any other device. To deny this allowance to a British-owned oil company is to impose a burden upon it when the oil is worked out and the land will revert to the desert it always was. One can see the increase in land values taking place at Kuwait, whereas, farther down the coast, at Bahrein, where the field is approaching exhaustion, the reverse process begins to operate."

SOUTH WALES BRANCH

A meeting was held at Britannic House, Llandarcy, on April 1, 1949, at which a talk was given by M. A. L. Banks (Member of the Council).

The subject was "Trends in refining practice" and dealt largely with methods of producing motor fuels. Comparisons were given of yields, octane number, T.E.L. consumptions, and steel requirement for equipment, using processes such as straight distillation and distillation combined with thermal reforming, hydroforming, thermal cracking, and catalytic cracking.

The speaker also dealt with the direct operating costs involved in different treatment processes such as the plumbite, copper chloride, bleach, solutizer plus plumbite, acid, and catalytic desulphurization.

An interesting discussion followed the talk.

PERSONAL NOTES

J. A. Rigby, A.M.Inst.Pet., informs us that he expects to be back in England at the end of August.

Colonel S. J. M. Auld, O.B.E., M.C., F.Inst.Pet., past-president, has been elected a visitor of the Royal Institution, and *Major W. H. Cadman*, M.B.E., F.Inst.Pet., has been elected a manager.

J. A. Oriel, C.B.E., M.C., F.Inst.Pet., has been elected a vice-president of the Royal Institute of Chemistry.

Dr G. M. Lees, F.R.S., F.Inst.Pet., has been elected a vice-president of the Geological Society of London, and *Dr W. L. F. Nuttall*, F.Inst.Pet., has been elected to the Council.

Dr W. J. Hayward, newly-appointed works manager at the Ruabon plant of Monsanto Chemicals Ltd., served with the Anglo-Iranian Oil Co. Ltd. prior to joining Monsanto in 1941. He succeeds *N. F. Patterson*, who is now general manager of production.

SIGNIFICANCE OF PROPERTIES OF PETROLEUM PRODUCTS

II. FLASH-POINT AND INFLAMMABILITY OF PETROLEUM PRODUCTS

By E. B. EVANS (Fellow)

THE flash-point test is very widely used, in conjunction with other tests, to classify and characterize petroleum oils and mixtures thereof and, in particular, as a guide to the fire hazards associated with their use and storage. The first legal use of a flash-point test in the U.K. was in 1868, and the Abel flash-point test was incorporated in the Petroleum Act of 1879. The Petroleum (Consolidation) Act of 1928 specifies the same method of test, and it is under this Act that regulations are laid down for the storage and handling of petroleum products with Abel flash-points of less than 73° F, and of various other substances such as calcium carbide and carbon disulphide. The main reason for the introduction of the Petroleum Acts was the danger associated with the use of very low flash kerosine in lamps.

More recently flash-point has been introduced as a principal feature into the legal definitions of kerosine, fuel oil, "light" and "heavy" hydrocarbon oils for taxation and Customs purposes, and to control the use of petroleum products in road vehicles. The conveyance of products by road, rail, or sea is also subject to regulations depending on the flash-point, particularly if this is below 150° F by the Pensky-Martens test.

The determination of flash-point is one of the many empirical tests which are applied to petroleum products. It may be defined broadly as the temperature to which an oil must be heated, under specified conditions, in order that it shall give off enough vapour to form an inflammable mixture with air. It is therefore obviously dependent to some degree on the volatility of the product and also on the "explosive limits" or "inflammable limits" of hydrocarbon vapours in air.

Under the general heading of "flash-points" are usually included "closed" and "open" flash-points and "fire-points". In the first class ("closed" flash-points) the product is heated in a closed cup, the temperature being gradually raised, and a small test flame lowered at intervals into the vapour space above the liquid until a flash occurs. In the determination of "open flash-points" there is no cover on the testing vessel, but otherwise the procedure is similar. "Fire-point" is the temperature at which an oil will ignite when a flame is applied, and thereafter burn steadily.

These various test methods are applied to the petroleum products for which they are suitable. The apparatus and methods employed are not the same in all countries, and it is important to realize that the actual values obtained are dependent on the procedure employed. The differences in results by, for example, the various open-flash methods are, however, not very large, and there are approximate relations between them.

CLOSED FLASH-POINT

Flash-points are not usually determined on very volatile products such as gasoline, since in such cases the results would be much below normal atmospheric temperature. For white spirits

and kerosines the instruments most widely employed are the Abel (Method I.P. 33/44) in the U.K. and the Tag closed tester (Method A.S.T.M. D.56–36) in the U.S. In France the Luchaire closed tester is used. In the Abel and Tag methods, heating is carried out using a water-bath round the oil cup; the Abel test may be used for oils with flash-points up to 120 F and the Tag test up to 175 F. For oils with higher flash-points (gas oils, diesel fuels, fuel oils, and lubricating oils), the most widely used apparatus for the determination of closed flash-points is the Pensky-Martens (Method A.S.T.M. D.93–46; I.P. 34/47).

Open Flash-point

The Cleveland open cup (Method A.S.T.M. D.92–46; I.P. 36/47), the Pensky-Martens open cup (Method I.P. 35/42), and the Marcusson instruments are widely used in the U.S., in the U.K., and on the European continent respectively for the determination of open flash-points. This test is applied mainly to higher-flash products such as lubricating oils, and in the U.K. it is usual to determine the closed flash-point of such products using the Pensky-Martens instrument and then carry on to obtain the open flash-point (using the same apparatus). In the U.S. the Cleveland open cup is used for open-flash determination, and it is not customary to determine a closed flash-point on lubricating oils. The apparatus for open-flash determinations is somewhat simpler than that for closed-flash measurements. There is sometimes the disadvantage, however, that small proportions of volatile, low-flash material which would be shown up by the closed-flash procedure, may be volatilized before ignition and thus be undetected by the open-flash method. Bitumens and similar products may also be tested by the open-flash procedure.

Fire-point

Fire-points are usually determined subsequently to open flash-points in the same apparatus. They are higher than the open flash-points by amounts which are dependent mainly on the value of the latter, and in consequence give little extra information.

Lower and Upper Flash-point

Flash- and fire-points may be expressed either in Centigrade or Fahrenheit temperature, but °F are usually employed. Strictly speaking, the flash-points normally obtained are "minimum" or "lower" flash-points. There are, however, two flash-points, a lower and an upper, in consequence of the fact that there is a range of composition between which hydrocarbon-air mixtures are inflammable. At temperatures below the minimum flash-point, the equilibrium vapour-air mixture is too weak to ignite; at temperatures above the upper flash-point the mixture is too rich. If, for example, a gasoline is cooled down using, say, liquid air, in a suitable apparatus and then allowed to warm up, a temperature will be reached at which the gasoline-vapour-air mixture above the liquid becomes inflammable. On further warming, the mixture will ultimately become too rich to support combustion, and the temperature at which this occurs is the upper flash-point. The explosive or inflammable limits for gasoline are approximately 1 to 7 per cent by volume in air. In consequence the vapour-air mixture above gasoline in a storage tank, or in the combustion space of a gasoline engine, may sometimes be too rich to ignite. Ormandy, many years ago, gave the rule that the lower flash-point of a product was the temperature at which its vapour-pressure equalled 12 mm mercury; this corresponds approximately to 1·4 per cent by volume of vapour in air. As a general rule, flash-point increases with decreasing vapour-pressure and volatility,

although small proportions of a very volatile constituent may cause a disproportionate lowering of flash-point.

In all the conventional flash-point methods, the petroleum-vapour-air mixture is ignited by means of a small flame. There are, however, other methods of ignition of such mixtures, for example, an electric spark, a hot wire, or other heated surface. When an electric spark occurs in a vapour-air mixture with a composition within the explosive range, whether or not ignition ensues depends upon the strength of the spark. A certain minimum intensity is necessary before combustion is initiated. Similarly for hot-wire ignition, it is found that a minimum current is necessary to cause inflammation. This minimum spark intensity or current necessary to cause ignition varies for different vapours, even when all other conditions are kept the same. In other words, the "ignitability" of the vapours is different.

Spontaneous Ignition Temperature

"Spontaneous" or "autogenous" ignition of petroleum products occurs when the product comes in contact with a heated surface at a sufficiently high temperature and with access of sufficient oxygen. The determination of spontaneous ignition temperatures (S.I.T.) is made using one of a number of apparatus which have been devised for the purpose. In general, the liquid product is introduced in small amounts into a heated metal or glass container, the temperature of which can be controlled and measured. An adequate supply of air is ensured and the minimum temperature necessary to cause sufficiently rapid oxidation of the product to lead to inflammation or explosion of the vapour is determined by trial. The conditions of the experiment have considerable influence on the results of the test. In general, the more volatile products have the highest S.I.T.'s; thus gasoline has a higher S.I.T. than diesel fuel, and lubricating oil lower than diesel fuel.

The fact that lower flash products are not always the most dangerous has been referred to above. It is, for instance, possible to cause a disastrous explosion in a tank containing kerosine in certain circumstances where gasoline would merely burn or perhaps not even ignite. The conditions of use and storage must be taken into account when considering the question of safety, and an oil and its vapour do not become "safe" in all circumstances just because the flash-point is above a certain prescribed numerical limit.

From the standpoint of ordinary storage and handling, however, oils are not normally considered dangerous if they have flash-points above 150° F. Flash-points of lubricating and similar oils are usually determined mainly to characterize the oil in conjunction with other properties. In some circumstances, however, lubricating oils may present a greater fire hazard than, say, gasoline. Owing to its lower S.I.T., lubricating oil may sometimes ignite on a hot metal surface (e.g., an exhaust pipe) when gasoline would merely evaporate. If the gasoline should then become ignited from the burning lubricating oil or from a spark it would burn very much more quickly and dangerously than would the lubricating oil, on account of its much higher volatility. Fire hazard cannot, therefore, be judged solely by flash-point or any other single property; all the relevant properties and circumstances must be given due consideration.

Suggestions for Further Reading

A few of the numerous sources of additional information, besides the "Standard Methods" of the I.P. and of the A.S.T.M., are listed below:

The Petroleum (Consolidation) Act, 1928.

S. G. Burgess, "The chemical aspects of the petroleum acts", *J. Inst. Petrol.*, 1947, **33**, 363.

H. F. Coward and G. W. Jones, "Limits of inflammability of gases and vapours", *U.S. Bur. Mines Bull.* 279, Washington, 1939.

A. W. Trusty, "The flash test", *Refiner*, September 1948, 471.
"Tag manual for inspectors of petroleum", C. J. Tagliablue Mfg. Co., Brooklyn, N.Y. 25th edn, p. 89 (comparison of flash tests of various instruments).
E. A. Evans, "Lubricating and allied oils", Chapman & Hall Ltd., London, 1945, p. 90 et seq.
"The science of petroleum." Various articles; e.g., p. 1406 "The laboratory testing of lubricating oils", A. W. Nash; p. 1428 "Methods for the analysis of fuel oil", F. B. Thole.
"Symposium on spontaneous ignition temperatures of fuels", *J. Inst. Petrol. Tech.* 1932, **18**, 533.

THE LONDON BRANCH VISITS ABINGDON

Good fortune smiled on the London Branch members on Saturday, June 25. Perfect weather, delightful hospitality by "Anglo" and "Esso", the charming atmosphere of Esso House, and a great deal to see of technical interest, combined to make this first social gathering of the London Branch a most happy occasion.

A concourse of cars, a coach, and a motor cycle converged on Abingdon, where members and their guests were received in the dignified atmosphere of Esso House by the branch chairman, A. J. Goodfellow. After an excellent lunch the company divided into three parties to tour the estate, the laboratories in general and in detail. The engine laboratories, chemical and physical laboratories, and the spectrographic laboratory provided ample interest both to the technical and non-technical visitor. We were indebted to members of the Esso staff who so kindly described what was seen. The gardens and estate were a pleasure to behold and are part of that indefinable and restful charm which we shall all associate with Esso House.

At least one distinguished member of our party succumbed to the languor of the summer day and slept beneath the trees whilst nominally watching a cricket match!

The end of the tours was a sign for the doffing of coats, and each to his taste played tennis or croquet, or putted. The least energetic watched the others whilst comfortably resting on the terrace. The atmosphere was that of the country house-party, and the mingling of members and their guests provided opportunities hitherto impossible, for members to get to know each other.

An excellent tea provided, we imagine, from the bountiful estate was the occasion for words of appreciation from Mr Goodfellow, who voiced the opinions of all in expressing thanks to our hosts, and in particular to Messrs Hughes, Dewdney and Arter. The prizes for the best rounds of putting were presented to Mrs G. H. Thornley and Mr D. A. Hough.

Regretfully the coach party left shortly afterwards, whilst some of the more fortunate stayed to enjoy a dance.

We are very much indebted to the Anglo-American Oil Company and the Esso Development Company for affording us the facilities which made the occasion one which will bring back nostalgic memories for years to come. Altogether a wonderful day.

THE "J.P." PUMP

Recently in London the "J.P." compressed air immersion pump was demonstrated by Messrs Jacobs & Partners Ltd., the distributors for the British Empire and Scandinavia. Originally designed for marine salvage work, the pump is operated by low-pressure compressed air, the air consumption being equal in pressure to the pressure-head of the liquid and in volume to the pump output at the working pressure. In its present forms the pump appears to have many uses, and full details are available from the distributors at Stone House, Bishopsgate, London, E.C.2.

"ANGLO" BOARD CHANGES

R. A. Carder

R. A. Carder, F.Inst.Pet., who has just been appointed chairman of Anglo-American Oil Co., joined the company in 1920, was appointed deputy secretary in 1925, secretary in 1930, elected to the board in 1933, and made managing director in 1939. During the last war he was a director of the Petroleum Board, and during the first world war, after service as a lieutenant R.N.V.R. in the Near East and France, was seconded to the Petroleum Executive.

During his leisure time Mr Carder is a keen gardener at his home in Westerham, Kent.

David A. Shepard, F.Inst.Pet., who has resigned his chairmanship of "Anglo" to become executive assistant to the president of the Standard Oil Co. (New Jersey) in New York, first served as research engineer with the Standard Oil Co. of Louisiana from 1927 to 1929. He then joined Hydro Engineering & Chemical Co. as a chemical engineer, and from 1930 to 1933 undertook research work for Standard Oil Development Co. and Standard Oil Co. of New Jersey. After a year as sales engineer with the latter company he became European representative of the S.O. Development Co. and from 1936 to 1940 was with the International Association (Petroleum Industry) Ltd. From then until 1942 he was technical adviser to Standard Oil Co., and in June of that year was appointed petroleum attaché to the U.S. State Department. In September 1943 he became shareholders' representative in Standard Oil Co. (N.J.).

David A. Shepard

In June 1945 Mr Shepard was appointed to the position he has now relinquished. He held many other business and professional appointments, among them being London representative of the Massachusetts Institute of Technology with the responsibility of assessing the potential general qualities of candidates for admission to the Institute.

Leonard Sinclair, who has been appointed an additional managing director of "Anglo", first joined the company at the age of thirteen as a junior clerk. Subsequently he was circuit manager and assistant manager, Birmingham; marketing specialist; branch manager, Preston; divisional manager, Bristol; and assistant general sales manager. In 1936 he joined the International Association (Petroleum Industry) Ltd., and in 1943 joined the board of "Anglo".

Leonard Sinclair

During the last war he was a director of the Petroleum Board and in the first world war served with the Welch Fusiliers, the Cheshire Regiment, and the Machine Gun Corps.

Mr Sinclair's recreation is golf, and he is vice-president and a past captain of Cuddington Golf Club, Banstead.

Howard W. Page, who has also been appointed a director of "Anglo", has had wide experience with the Standard Oil Co. in relation to refining and economic matters.

COUNCIL COMMENTARY

In the unavoidable absence of the President, Dr E. B. Evans presided over a fair attendance of Members of Council on June 8 at Manson House.

Formal passing of the minutes was followed by discussion of confidential matters arising in connexion with the awards of the Cadman and Redwood Medals.

A very hard case concerning one of our members who had lost all through the war was considered with sympathy and dealt with generously.

The Education Committee report had not been circulated and was not therefore formally presented. Mr Thornton emphasized again that we now had an examination available with a syllabus produced jointly by ourselves and the City and Guilds of London Institute. This was intended to be to all intents and purposes our examination and, though it had obvious limitations, these could and would be corrected in due course when the time came for revision. Meantime it should receive the full support of the Institute and the industry, as a first step towards our becoming a qualifying body in a more real sense and this enhancing the value and prestige of our Associate Fellowship.

The Council had already, by previous resolution, decided to become such an examining body at least by proxy and unless this minute was rescinded such a resolution called for support and encouragement for students to take this examination. The Institute should encourage the establishment of courses to this end. Such courses were already running, but none in London.

Mr Dewhurst reported having advised the Parliamentary and Scientific Committee of the national importance of geological surveys.

Various Council committee constitutions were presented and agreed, 125 jobs being filled by 68 people, indicating many willing horses with more than one office and also giving some idea of the widely spread net of Institute committee activites over and above the limited numbers of Council members.

The Oil Measurement Conference to be held in Brussels had the blessing and good wishes of Mr Victor Butler, sent in a letter to the General Secretary. It was hopeful of carrying a step further this international collaboration which is so useful on such matters and for which the Institute of Petroleum has done so much through the efforts of Mr Hyams.

The General Secretary read a letter from our President to Sir Henry Guy, Secretary of the Institute of Mechanical Engineers indicating the importance of appointing, in an honorary capacity, technologists expert in lubrication matters to assist in the work of the newly established Research Station of the Institute of Mechanical Engineers at East Kilbride.

The General Secretary reported on his attendance at the first meeting of the Organizing Committee of the Second Oil Shale and Cannel Coal Conference to be held in Scotland in 1950. With Mr R. Crichton as chairman, Mr W. M. Stirling as secretary, and Mr Meickle as treasurer, a working committee has already made considerable progress and foresees a self-supporting congress, since already 25 per cent of the necessary numbers have registered.

The Election Committee report was presented and accepted, bringing the Council proceedings to an end for this meeting.

RESEARCH IN TEXAS

The Southwest Research Institute, San Antonio, Texas, has established a division of petroleum technology in Houston. Its object is to undertake research into problems of interest to those engaged in the petroleum industry in that area.

W. E. JENKINS, C.B.E.

William E. Jenkins, a director of Anglo-American Oil Co. Ltd., was awarded the C.B.E. in H.M. Birthday Honours for his services as Controller of the Finance and Accounts Division of the Petroleum Board. He was actively associated with the Board during the whole of its operations. He first joined "Anglo" in 1920 and for some years has been the member of the Board responsible for financial, secretarial, and general administration subjects.

INDUSTRIAL CHEMISTRY CONGRESS

The 22nd International Congress on Industrial Chemistry will be held this year in Barcelona from October 25 to 30, 1949. Among the subjects to be covered are solid and liquid fuels; factory management; laboratory equipment and methods of testing; the scientific and technical organization of teaching and research.

Enquiries are welcomed by the organizers, the Société de Chimie Industrielle, 28, Rue Saint-Dominique, Paris (VII).

ANGLO-IRANIAN OIL CO. LTD.

In his statement to stockholders, the chairman of the Anglo-Iranian Oil Co. Ltd. reports that during 1948 the company's crude oil production in Iran totalled 24,871,000 tons from the four main fields at Masjid-i-Sulaiman, Haft Kel, Agha Jari, and Gach Saran.

From Kuwait the company obtained 3,146,000 tons from the total production of 6,291,577 tons, and from Iraq 1,292,000 tons of crude, including 370,000 tons from their Naft Khaneh field and the balance from their interest in the Iraq Petroleum Co. Development at Qatar is satisfactory, and the Basrah Petroleum Co. has located oil structures near Basrah.

United Kingdom

Scottish shale-oil output was 109,600 tons of crude oil, and the Eakring oilfield produced 43,400 tons. Testing of other areas disclosed no further sources of commercial production.

Other Areas

In Australia the geological work carried out showed no justification for further activities in areas the company were testing in partnership with other companies. In Papua, oil search is continuing. Survey results in the Bahamas have been discouraging, and in India and Pakistan exploration has been on a reduced scale.

Refining

Abadan refinery processed 20,936,113 tons of oil. The Haifa refinery was shut down on April 13, 1948, and total throughput for 1948 was thus only 962,941 tons.

The throughput at Llandarcy was 780,724 tons and expansion to 3,000,000 tons p.a. is well advanced. Grangemouth throughput was 460,027 tons and work on expansion to 1,500,000 tons p.a. has begun.

In France the L'Avera refinery of the Soc. Générale des Huiles de Pétrole processed 998,063 tons of crude, and capacity is to be increased to 1,200,000 tons p.a.

Pipelines and Tankers

During 1948 the main pipeline system in Iran was increased by 120 miles to 1,668 miles and 2,250,000 tons of crude were shipped from Abadan.

The British Tanker Co.'s fleet increased to 121 ships of about 1,430,000 deadweight tons. Sixteen new ships were delivered during the year, and one was scrapped. Ships under construction number thirty-nine, totalling over 570,000 dead-weight tons, and six are of 28,000 dead-weight tons each.

M.I.R.A. RESEARCH LABORATORY

THE Motor Industry Research Association was "at home" on June 23 and 24, when visitors to the Association's Great West Road laboratory were invited to inspect the work in progress.

Regarding initial researches, the Association pointed out that very little additional equipment had been installed during the past year, work having been devoted to furthering the progress of research already in hand. Facilities for complete vehicle research, development, and testing are available at the Association's proving ground at Lindley, near Nuneaton (see *I.P. Review*, July 1949).

Two outdoor exhibits, normally in use at Lindley, attracted considerable attention. One was the two-ton dynamometer trailer car, designed for imposing easily adjustable loads and automatically controllable speeds on towing vehicles. The other, a double-decker omnibus, painted a war-like battleship grey, has been equipped with wire resistance strain gauges and the M.I.R.A. four-channel recording equipment, in order that stresses in the structure of such public service vehicles may be measured.

In the laboratories there is much to be seen of interest. Work is in progress on the development of an engine test method which will differentiate on a broad basis between lubricating oils for C.I. engines. Experiments are being carried out in connexion with exhaust-valve failure in engines run on petrol containing a high proportion of tetraethyl lead. The life of valves made from different materials is compared, it being shown that with certain valve materials it is possible, with fuels having lead contents up to 5½ ml T.E.L. per gallon, to obtain exhaust-valve life comparable with that of Silchrome I on Pool petrol.

M.I.R.A. is using a recently constructed machine for the study of abrasive wear of materials in relative reciprocating motion, and another for the study of the effect on joining and bearing wear of abrasive contaminents in lubricating oil. In the chemical laboratory, too, a number of abrasive wear tests were being carried out.

REFINING IN TRIESTE

On April 18 the millionth ton of crude oil was discharged at the Aquila refinery (in Trieste) since its reconstruction, two years after the severe bomb damage sustained during the war.

The reconstruction of the Aquila refinery was started in 1946, and by May 1947 operations were resumed in the rebuilt atmospheric and vacuum plants, chemical treatment plants, and in the accessory installations. At the same time throughput capacity of the refinery was increased, and it is now more than 140 per cent of the pre-war capacity.

Roughly three-quarters of the oil goes to the Italian market and the Free Territory of Trieste, whilst about one-quarter is exported and sold for bunkers.

It is reported that active discussions are now proceeding for the construction of a modern plant for the production of about 25,000 tons per annum of the full range of 100 V.I. lubricating oil from Middle East crude. It is expected that this plant will be in full production at the beginning of 1951.

DEEPEST ROCKY MOUNTAIN WELL

Pacific Creek No. 1, being drilled by Superior Oil Co. on a wildcat location in S.W. Wyoming, has already passed the Rocky Mountain record depth of 16,500 ft. Major elements of the rig are of National Supply Co. manufacture and the dual-fuel drilling engines have a combined h.p. of 2010.

SOME IMPORTANT FACTS*

By JOHN R. SUMAN

(Vice-president, Standard Oil Company, New Jersey)

DURING 1948 more oil was produced in the United States than ever before, and yet, during the first part of the year, oil producers were hard pressed to meet the demand. It was necessary, therefore, in order to supplement domestic production, to import a lot of oil.

As the year progressed, the supply situation eased, and petroleum imports into the U.S. have been reduced since the beginning of this year, and further decreases are in prospect. With an improved supply position, there have also come, however, statements that oil imports are of such volume as to penalize domestic producers. Economists have recently made an analysis of the actual physical movement of petroleum into, within, and out of the United States during 1948. And two rather surprising facts have come out of that analysis.

U.S. OIL MOVEMENTS

The first is that the United States actually produced more petroleum in 1948 than it consumed—in fact, about 413,000 barrels a day more. Now this seems surprising when we consider that 1948 is remembered by all of us as a year of tight supply. How could it have been, if we actually produced more oil than we consumed? The answer lies in part in the fact that the figure of 413,000 barrels daily production in excess of domestic consumption is an average for the year. The tight supply situation was most severe in the early part of 1948 and, as I have said, that situation improved greatly in the latter part of the year.

More importantly, though, the seeming paradox arises from the fact that in 1947 total world demand did exceed total world supply, because foreign oil could not be produced as rapidly as oil was being consumed outside the United States. This resulted in a draft on stocks in the United States, so that in 1948 a considerable proportion of domestic production was necessary to rebuild stocks.

The second fact is that last year there was more petroleum shipped out of the United States than was moved in—about 122,000 barrels a day more.

This seems surprising when we consider that government oil statistics have been widely interpreted as showing that in 1948 the nation was a net importer.

Does this mean that something is wrong with the Bureau of Mines' figures? Not at all. The figures are entirely correct. But the value of these statistics, like all statistics, lies in their proper use. They require knowledge of how they were compiled and of what they include or do not include in particular items.

In talking about the effect of imports, we cannot arrive at a real understanding unless we start out by accounting for all the oil that appears in the U.S.—that is, total supply—and all the oil that disappears—total demand—within a given period. The two sides of the ledger must balance. If so much oil appears or is made available, and only so much shows up in storage tanks at the end of the period, some demand must be listed to account for the oil that has disappeared.

In striking their balances, the petroleum statisticians may list quantities and classifications of petroleum under terms whose precise statistical meanings may be far different from the meanings those same terms usually have for you and me.

For example, Government petroleum statisticians issue figures which they call "domestic demand", "imports", and "exports". It might be assumed that

* Summary of an address to the A.P.I., Eastern Division, on April 28, 1949.

"domestic demand" means consumption within the U.S.; that "imports" mean the amount of petroleum brought into the U.S.; and the "exports" include all petroleum moved out of the country for consumption or accumulation elsewhere.

As the statisticians use the term "domestic demand" includes quite a lot of oil that is not consumed in the United States. It includes the fuel oil used by many ships operating in foreign trade (167,000 barrels daily during 1948). Almost 44 per cent of that oil—about 70,000 barrels—originated at supply points outside the U.S. and was brought under bond only because it was clearly understood that it would not be consumed in the U.S. Yet these bunkers, which originated and were consumed outside the U.S., are included in the statistical reports as both "imports" and "domestic demand".

Another instance of petroleum statistics not always meaning exactly what they seem to say, is found in connexion with the item of military purchases. Last year the armed services bought in the U.S. about 170,000 barrels of petroleum a day (including some 65,000 barrels of aviation fuel).

A large portion of the aviation fuel was consumed in the U.S.; but some of it, and practically all of the other petroleum purchased, was moved out of the country by the armed services. All this petroleum, estimated at more than 100,000 barrels a day, was consumed outside the U.S., but is included under "domestic demand".

During 1948 petroleum from Venezuela, other Latin-American sources, and the Middle East moved into the U.S. at the rate of 513,000 barrels a day. At the same time, petroleum moved out at the rate of 635,000 barrels a day, a difference of 122,000 more barrels moving out than came in. Those 122,000 barrels came from domestic production.

Last year the domestic oil industry poured 291,000 barrels a day into the nation's storage tanks, with the result that stocks were at an all-time high at the end of the year. Adding 291,000 and 122,000 we find that the U.S. actually produced about 413,000 barrels a day more petroleum than it consumed during 1948.

U.S. Operations

If imports into the U.S. were not large enough to cover withdrawals for foreign consumption, let alone displace domestic oil in domestic markets, then what has caused the cutbacks in domestic oil operations?

Ever since the end of the war, the U.S. petroleum industry has been expanding at an unprecedented rate. By the end of 1948 producing and refining capacities were more than one million barrels a day greater than they were during the peak war effort. But, until late in 1948, this expansion was able to do little more than keep abreast of a soaring domestic consumption of oil, while simultaneously overcoming the deficiency in foreign supplies.

Then, shortly before the end of last year, the situation began to change. By December 1948, steadily rising domestic production had reached a level some 630,000 barrels a day higher than the average domestic consumption for all of 1948. At the same time, stock tanks were almost full, and domestic consumption of petroleum showed no increase over the previous winter, mainly because of mild weather in the eastern states.

In other words, we had moved from a period of tight supply to a period of surplus. A similar change from scarcity to sufficiency in oil supplies has taken place abroad. As a result, the domestic petroleum industry to-day has spare capacities. This is a very good thing, because once again it gives a cushion against emergencies.

However, with both the U.S. and the rest of the world moving out of an abnormal period of threatened petroleum shortages into a more normal period of plentiful supplies, it is inevitable

that some adjustments have to be made, and many companies have cut back crude oil production and refinery runs.

It is a good thing Middle East oil was available for import when U.S. domestic supplies were tight. A year ago the papers were full of "oil shortage" headlines, and politicians were clamouring for the Government to do something. There were plans to build a huge synthetic industry. There was the threat of rationing. The stupendous effort of the domestic industry, coupled with Middle East oil imports, pulled us out of that difficult position.

Some people may ask why—in the present period of adequate or even excessive supply—Middle East imports should be continued at all. So far as Jersey is concerned, one reason is that our Middle East imports are made under contractual arrangements.

The reason for continuing imports from other areas is that they represent specialty crudes, residual for East Coast markets and for ships' bunkers, and enough additional crude to cover the amount of refined products shipped abroad.

Residual Fuel Economics

For many years the outlet for residual fuels on the East Coast had been considerably in excess of the domestic supply economically available from East Coast and Gulf Coast refineries. The economics of residual fuel oil production are quite different from those of most other petroleum products. It must compete with other fuels, while gasoline does not. In general, it cannot be sold in any substantial volume at prices higher than parity with coal, plus a small premium for lower handling costs and higher burning efficiency.

Residual prices are low in relation to crude prices. Obviously, any refiner is interested in obtaining the maximum yield of products which sell for more than his crude cost, and he has a strong incentive to install additional equipment which will result in still lower yields of residual.

Present yields of residual fuel in refineries east of the Rockies average about 19 per cent on crude runs. This amount is being decreased as new refining processes are developed. Residual fuel imports could, therefore, increase considerably without affecting any domestic production—or the business could go to coal and gas.

There is, also, a national security reason to provide the domestic residual market with imported residual fuel. In case of war, industries using residual fuel in the U.S. can, in many cases, be converted to coal and gas, if necessary. Ships cannot. The importance of offshore oil is re-emphasized when we remember that, during the last war, foreign supply sources provided 35 per cent of military and bunker demands after taking care of the essential foreign civilian requirements.

The three reasons for importing—a need for specialty crudes, residual fuel, and processing for export—are reasons for importing even while there is adequate domestic production of crude oil.

Petroleum needs in the United States are expected to increase steadily, although at a slower rate than during the first post-war years. Domestic producers will be kept busy finding and developing enough petroleum to satisfy growing domestic consumption, to maintain a high level of proved reserves, and to provide a margin of productive capacity which can be used in case of emergency.

But there will always be a need for imports to fill the special categories mentioned, and such imports are within the framework of the National Oil Policy.

Artificial trade restrictions, adopted out of motives of short-term advantage for one segment of an economy, are "penny-wise and pound-foolish". If such policies led—as well they might—to inability to supply customers with the

products they wanted when they wanted them, or to price levels for oil products which priced us out of business, or to serious dislocations in the world trade pattern, there could be political repercussions which would make any present problems of the oil industry seem like a picnic.

In my sincere opinion, imports are not, and need not be, a threat to the domestic producer. Instead, they are the balance wheel of supply, making it possible to meet efficiently the great and growing needs of our nation, and enabling the industry to move forward in strength and with freedom.

TRINIDAD BRANCH DINNER

THE Eleventh Annual Dinner of the Trinidad Branch of the Institute was held at Port-of-Spain on April 30, 1939, the chairman of the Branch, F. C. Hamilton, presiding. Among those present were H.E. Sir John Shaw (*the Governor*), P. M. Renison (*Colonial Secretary*), A. R. W. Robinson (*Financial Secretary*), A. Wilcox Wilson (*Attorney General*), A. C. Rienzi (*acting Solicitor General*), E. W. Leach (*Director of Agriculture*), G. Henderson (*acting Director of Works and Hydraulics*), L. Spence (*Comptroller of Customs*), S. J. Hogben (*Director of Education*), E. Grell (*President, Chamber of Commerce*).

"H.E. THE GOVERNOR"

Proposing this toast, the chairman (F. C. Hamilton) reminded his audience that it was 21 years since the Branch had been formed under the chairmanship of Sir Thomas Holland. There were 29 founder members; now they numbered 110.

They had heard recently of the licence to Trinidad Leaseholds to import, free of duty for 25 years, crude from outside sources. This was necessary to safeguard the refining position, but it was a sad commentary on the overall position of the Island that it should be so. That the balance between refining and production must be re-adjusted was fully appreciated by everybody, and the most strenuous efforts were being made to improve both the short-term production position, still hampered by shortage of equipment, and the long-term position by the active search for new sources of production.

He directed attention to the high and increasing cost of production per barrel —a factor which ultimately dictated how much of the presently available reserve could be profitably extracted. Combined with the meagre Island reserve of 250 million barrels, this was of the greatest significance in any long-term planning. At the present Island rate of production of 20 million barrels per year this reserve represented only 12 years' production. Production would continue at a constantly dwindling rate for more than 12 years but, if new reserves were not discovered, the decline would be more rapid and the 1940–2 peak of 22 million barrels per year might be the all-time high.

HIGH COSTS

There were many reasons for the high cost per barrel:

(*a*) Geological conditions governing the accumulation of oil in Trinidad were extremely complicated. In other areas either stratigraphy or tectonical conditions were complicated but seldom, as in Trinidad, both at the same time. Indeed, the geologists' lot was not a happy one.

(*b*) If a discovery were actually made, again the conditions were less favourable than elsewhere. In the Venezuelan lake fields, for instance, it was sometimes possible by the drilling of only 10 widely

spaced wells to prove up an area of 500 locations and more. In Trinidad it was very unlikely to prove more than half a dozen locations with any well drilled.

(*c*) Even if these difficulties were overcome, it was all too often found that the producing sand was of such fine texture and so unconsolidated that it could not be excluded, even by the finest screen pipe, without also prohibiting the entry of oil into the well. This difficulty was not peculiar to Trinidad, but certainly added to the cost of production and reduced the total amount of recoverable oil.

(*d*) During the course of drilling operations they had also to deal with underground pressures considerably in excess of normal oilfields pressures. These high pressures call for the use of drilling muds of 125 to 140 lb cu.ft., compared with 80 to 90 lb mud normal in other areas. Drilling mud was very costly to prepare, needing skilled supervision in preparation and heavy duty pumps for its handling. On a deeper well the cost of the mud alone could often amount to $50,000 to $80,000.

(*e*) After all these difficulties have been overcome, resulting production was very often very disappointing. The average total yield per well in Trinidad was only about one-fifth of the equivalent figure for Venezuela.

It was against this background, said Mr Hamilton, that they should view the efforts of the technologists of Trinidad to reduce or maintain costs at economic levels. This effort must be continuous in view of the ever rising cost of operations and equipment, not to mention taxation, and he hoped that the technologists could always keep them at least one step ahead.

Deeper Drilling

In the 21 years that the Trinidad Branch had been in existence, many important technological advances had been made, not the least those associated with deeper drilling. The finding of new reserves at present depths was unlikely and efforts must be concentrated on searching for new deeper pools.

During and immediately after the war, exploration had lagged behind, due partly to lack of adequate equipment. Now, this was becoming available and many companies had started large-scale exploration. The question—what are our future reserves?—would possibly be answered within the next few vital years.

Heavy duty equipment for drilling to depths well below 10,000 ft was necessary. In general he thought it was not unfair to say that to drill a well to 10,000 and 12,000 ft in Trinidad called for the same equipment and engineering skill that would go into a 15,000 to 17,000-ft well elsewhere.

Despite what he had said, the industry was optimistic of its ability to do the job efficiently. By large-scale exploration and the encouragement of optimum recovery methods, it should be possible to slow up the decline of indigenous production.

His Excellency the Governor, replying to the toast, said that many people blame scientists, with whom must be coupled the petroleum technologists, for a great many of the evils in the world to-day. Those persons who believe this were like ostriches who bury their heads in the sand.

In Trinidad, they were fortunate to possess a prosperous and progressive oil industry which played a vital factor in economy and provides them with much revenue and more employment.

The Governor concluded by wishing continued success to the oil industry, upon which depended so much.

"The Industries of Trinidad"

The Hon. H. A. Bennett, proposing this toast, said that due to the abnormal condition of world supply and demand the profits earned "on paper" by industry in 1948 possibly exceeded any previous record. Those profits were

shortly to be put in a very much reduced condition by the incidence of a 40 per cent tax on profits, which removed the gilt from the gingerbread.

This substantial interest of Government in the profits of industry was in addition to such items as Customs duty, oil royalties, and other substantial amounts extracted from industry.

Concluding, Mr. Bennett said their first task was to get all public opinion on the side of private enterprise. With public opinion lined up they must tackle the Government, the politicians. They would stress the need for stable conditions to attract outside capital, and for a wise taxation policy to induce internal capital to become available for re-investment. Surely, however difficult this might be, Government and the politicians must see that the need to expand industry at a rate equal to that of the population transcend all other considerations.

Mr E. Grell (*President of the Chamber of Commerce*), replying, said that when he saw a gathering of so many experts in the art of extracting oil from subterranean places, he always had a nervous feeling that the remarks of an old coloured clergyman in the Southern States might possibly be true. This old clergyman, attempting to describe hell to his congregation, stated that the world revolved on an axle; that the axle was greased by the oil under the surface of the earth; that the oil companies were extracting this oil and that when they had extracted a sufficient quantity the axle would run hot and then, declared the minister, that would be hell in truth.

Mr Bennett had made out a case for industry and he could do no more than to endorse the words of wisdom which he had uttered.

Although they felt justified in seeking from Government a reduction in the present high rates of income tax, and although there can be no gainsaying the fact that such a reduction was strictly necessary, nevertheless they realized that having built up a scale of expenditure which would be a constant strain on the finances of the Colony, it was difficult to reduce that expenditure, especially as it affected the social welfare of the people. He felt that they must continue to press for a reduction on taxation must help the Government to achieve that end. There should be a very careful watch on Government spending and all companies and individuals should contribute their rightful share of income tax.

"Our Guests"

Proposing the health of the guests, B. W. Halse, said the development of the oil industry owed a lot to the vision and reasonableness of the Government in the past and he believed that that far-sighted attitude still prevailed. He expected they had all noticed one particular characteristic in which all governments agreed. Every government in the world regarded each oil company within its grasp as something ripe to be picked, plucked, and milked. Governments would probably say they should feel flattered that they never forget or neglect them. Some governments would say it was better to have taxed and made bankrupt than never to have taxed at all.

A. R. W. Robinson (*Financial Secretary*), speaking on behalf of the guests, thanked their hosts for a very enjoyable evening.

At the conclusion of the speeches, the members and their guests adjourned to the dance floor.

Obituary

ARTHUR T. BEAZLEY, M.B.E.

It is with regret that we record the death on July 19 of Arthur Tetley Beazley, M.B.E., a Fellow of the Institute and one of those who agreed to join the Institute prior to its foundation in 1913. He was a Member of Council from 1947 until 1949.

ELECTRICAL INSULATING OILS

Stanlow Branch concluded their 1948–9 session by a return to one of their previous meeting-places, the Grosvenor Hotel, Ellesmere Port, to hear, on March 30, 1949, a paper by J. C. Wood-Mallock on the subject of "Electrical insulating oils".

After mentioning the fundamental importance of the electrical non-conductivity of hydrocarbons, the lecturer proceeded to deal with the special characteristics of the types of oils employed in the main classes of oil-using electrical equipment: transformers, circuit breakers, power cables, and capacitors.

Transformer Oils

Although insulation resistance was a primary requirement, the main function of an oil in a transformer was to act as a coolant, and a transformer oil specification had to be planned with this function in mind. After outlining the basic constructional features of an electrical transformer the desirable properties of oils to be used therein were discussed. It was only relatively recently that it was realized that low sludge formation in an oil was not the only property of importance, and present tendencies, as reflected in many specifications, were to control strictly the acidity development that could be permitted in a transformer oil. The long service life that the electrical industry expected from such an oil was stressed and the difficulty of foretelling this from a short-time laboratory test explained. In its acceptance of inhibited oils the electrical industry in this country was some way behind its counterpart in the U.S.A., but the lecturer was convinced that the general recognition of the advantages of such oils was only a matter of time and that their widespread use was inevitable. The desirability of a certain aromatic content in transformer oils, to impart stability, was mentioned, the figure of approximately 15 per cent aromatics among the hydrocarbon groups composing the oil being suggested as an optimum.

Switch Oils

In contrast to the prolonged operation at moderately high temperature (such as 70° C) which was the function of a transformer oil, an oil intended for an oil-filled circuit breaker had to stand up to extremely high temperatures, well above its boiling-point, but only for an extremely short time on any one occasion. The principal function of a switch oil was to act as an arc quencher; switch fires were a serious hazard, and means for the reduction of this risk in hydrocarbon oil-filled switches would have to be found.

Cable Oils

The oil in power cables, as distinct from that in switches and transformers, served as a dielectric which rendered its power factor an important characteristic. The formation of wax in cable oils by the action of electric stress was mentioned, and the reasons for the requirement that certain types of cable oil should possess gas-absorbing properties was explained. Stability was an essential requirement of all types of cable oil.

Condenser Oils

In condensers (capacitors) mineral oils served primarily as insulators; these items of equipment operated at low temperatures and under high electrical stresses. Desirable characteristics in a condenser oil included high dielectric constant, so that the size of the equipment could be kept as small as possible, and low power factor.

The lecture was followed by an extremely vigorous discussion in which an unusually high proportion of the audience participated, and the meeting

concluded with a vote of thanks proposed by D. H. Japes.

In concluding the proceedings the chairman announced that the hon. secretary of the Branch (J. G. Hancock) was relinquishing that office and expressed the thanks of the Branch to him for the very hard and efficient work which he had put into the carrying out of his duties. This expression of appreciation was echoed from the floor by A. D. Makower, on behalf of the Branch members generally, and heartily responded to by the audience.

SPEED LAUNCHES FOR OIL OPERATIONS IN VENEZUELA

Now on order with U.K. builders, for Venezuelan Oil Concessions Ltd., one of Shell's operating companies in Venezuela, are six aluminium alloy high-speed launches, each 53 feet long and capable of carrying twenty passengers and oil-drilling equipment at a minimum speed of 18 knots.

These launches, which have a draught of 3 ft 8 in and a beam of 13 ft, will be used to carry crews and drilling gear out into Lake Maracaibo where, 24 miles from the shore, underwater drilling is taking place.

The specification of the launches calls for aluminium alloy because it has been found that this type of construction—costing three to four times as much as timber—is better able to withstand the rough weather in Lake Maracaibo and to resist deterioration caused by the fierce sun, general climatic conditions, and the Teredo worm, which eats into timber hulls.

Keystone Driller Co. have issued a descriptive leaflet in their Krane Karrier, a self-propelled mounting for all makes of crane from 10- to 25-ton capacity. Copies are available from 419 Wood Street, Pittsburg 22, Pa., U.S.A.

ORGANIC CHEMICALS FROM PETROLEUM

At a meeting of the Scottish Branch of the Institute of Petroleum, held in Glasgow on February 23, 1949, Dr W. L. Wood, of British Petroleum Chemicals Ltd., delivered a lecture on "Organic Chemicals from Petroleum".

Dr Wood explained that the petrochemical industry occupies a place between the petroleum industry and the heavy organic chemical industry and has been developed in the U.S.A., where natural gas and the gases from the cracking of oil have been converted into synthetic rubber, alcohols and solvents.

In Great Britian the development of the petrochemical industry has been delayed due to the lack of oil and gas reserves, while the liability for duty on oil used for synthetic purposes has also acted as a deterrent to the setting up of plants in this country. This liability for duty has now been removed, and four companies are now either engaged or about to engage in the manufacture of useful products from petroleum. British Petroleum Chemicals Ltd., propose to spend a sum of over £5,000,000 in the erection of works at Grangemouth, where solvents and raw materials for the plastic industry will be produced.

Mr Robert Crichton, J.P., the managing director of Scottish Oils Ltd., occupied the chair at the lecture and the attendance was over eighty.

WAKEFIELD'S JUBILEE

In connexion with their recent Silver Jubilee celebrations, Messrs C. C. Wakefield & Co. Ltd. have issued an attractive booklet entitled "50 years of progress in scientific lubrication". It contains numerous illustrations of the use of lubricants, with particular emphasis on transport on land and sea or in the air. Many speed records are referred to.

OIL REFINERS' FUTURE TASKS

The manufacture of synthetic fuels from coal and shale, and the rapidly increasing production of chemicals from petroleum were recently discussed by Chester F. Smith, vice-president, Standard Oil Company (New Jersey), in an address on "The future of oil refining" to the American Petroleum Institute.

Current suggestions that an immediate start should be made in the United States on a large-scale programme for the construction of synthetic plant using coal and shale were extremely important, he said. For coal and shale were major potential sources of light liquid fuels, and quite probably one or both would come into substantial use some time in the future.

It was questionable, however, whether national welfare would be served by starting such a programme now, for there was every evidence that for many years western hemisphere crude oil production would continue to be adequate for western hemisphere requirements.

"We are not running out of oil," he said.

But, if necessary, there was another alternative source of light liquid fuels—residual fuel oil—which could provide increased quantities of light products more economically and more rapidly than they could be obtained from synthetic plants. For even if the demand for petroleum products should reach the level of crude oil availability, the refineries would be producing large quantities of residual fuel oil which could serve as a better raw material than coal or shale for an increase in the manufacture of light fuels.

Such a solution to the problem would involve in many areas the direct substitution of gas or coal for some of the present uses of residual fuel oil, and the direct production of lighter fuels from that residual. Synthetic production of liquid fuels, on the other hand, meant the indirect, expensive, and less efficient manufacture of oil from coal or shale. Synthetic plants required larger investments, more manpower, and greater operating costs than the processing of residual.

All of these facts pointed to the one conclusion: there was a serious question whether there was any economic, conservation, or national security need for embarking now on large-scale construction of synthetic plants.

Mr Smith made it clear, however, that he did not mean to imply that there would not be a time when synthetic production might well be justified. For that eventuality, oil company laboratories and pilot plants have been working on the problems for more than a decade, and had already solved most of them. The study and development of processes would continue in the effort to make them increasingly more efficient. Whenever the time came, the oil industry would be ready.

Turning to the production of chemicals from petroleum, Mr Smith said this was an excellent example of small beginnings growing into large projects, and promising even greater opportunities in the future. The petroleum chemical business started with a small production of alcohol from cracking gases. But the growing realization of the usefulness of petroleum as a raw material for chemicals soon enabled it to yield so-called coal-tar chemicals, and the equivalent of grain alcohol. Up to the beginning of the last war, toluene had been almost 100 per cent a coal-tar product. Then, almost overnight, it seemed, more was being produced from petroleum than from coal-tar. And petroleum refineries became war-time rubber plantations. They were still producing large quantities of raw material for synthetic rubber.

The United States' Tariff Commission reported that the sale of organic chemicals produced from petroleum and natural gas exceeded three billion pounds

in 1947. Although this was not a large figure in comparison with the great volumes with which the oil industry was familiar, it demonstrated that chemicals from petroleum represented a development of increasing importance, and one which certainly would not be neglected. Products made from the chemical building-blocks of oil entered the lives of everyone in hundreds of ways, and they offered significant opportunities for contributing to better living.

In this connexion, there was a notable trend towards the isolation of essentially pure compounds from petroleum. An example was the production of *cyclo*-hexane for use in the manufacture of nylon. To get those pure compounds it would be necessary to develop better separation methods, which was another important job for the future.

Future refining operations would increase both in complexity and flexibility. They would be more complex because the variety of products from petroleum was expanding continuously, and because many products were the result of highly involved processes. They would have to be flexible because rapidly fluctuating demands for individual products required techniques readily adaptable to changing needs.

WORLD OIL POSITION

THE following is extracted from the 1948 Report of the Royal Dutch Petroleum Company:

During 1948, world-wide refinery capacity, though considerably increased, was still not sufficient to supply all demands.

Through nearly all of 1948, supplies in the United States were no more than adequate to meet domestic demand, in spite of heavy imports of crude and fuel oil from the Caribbean area and from the Middle East. As a result, the prices of all products remained high and firm until the last two months of the year, when the domestic prices of fuel oils started to weaken.

The high level to which fuel oil prices were forced in December 1947 and at which they were maintained for almost a year, undoubtedly reacted on consumption, and we regard the falls which have taken place as in the nature of healthy correctives. The extremely mild weather conditions in the United States, which greatly reduced normal demands and caused stocks of heating and fuel oils to accumulate abnormally, gave momentum to this downward trend.

The consumption of fuel oils in the troubled and slowly recovering world outside the U.S. also fell short of expectations, although to a much smaller extent than in the U.S. This, together with the weakening in the U.S. fuel prices, resulted in a reduction of world prices for fuel oils. Such a swing of the pendulum from widespread shortage of fuel oils, accentuated by transportation difficulties, to a surplus of supply and ample transport is a feature to which the oil industry is susceptible, though the full flexibility of operations, especially in refineries, which the larger units of the industry and our group in particular have built up, enables adjustments to be made, which to some extent minimize the economic consequences of these fluctuations in the relation between supply and demand.

The progressive increases in demand for petroleum products in general continued in 1948, though in most areas outside the United States these increases were restrained by restrictions imposed in varying forms, having their origin in the currency and economic problems of post-war world adjustment. In many areas progress is still hampered by continued disturbances. Although it is

difficult to forecast how rapidly world consumption of petroleum will continue to expand, there is no doubt that the room for expansion is very great if the interests of a wide range of potential consumers are to be met. As an indication, the estimated requirements of the countries participating in the European Recovery Programme — requirements which are based on an estimate of essential needs—foresee an aggregate consumption of petroleum products in 1953 about 33 per cent above the present consumption level. Similarly, the requirements of markets in Africa, the Far East, and South America are likely to grow at least as rapidly.

Production figures show that the world production of crude oil, including natural gasoline, increased by 13 per cent from 432 million metric tons in 1947 to nearly 489 million metric tons in 1948:

WORLD PRODUCTION

Country	*In million metric tons*†		*In million barrels*	
	1948	1947	1948	1947
U.S.A.	292·50	269·20	2161·8	1989·2
Venezuela ..	70·72	62·49	490·6	435·1
U.S.S.R. (incl. Sakhalin)*	30·60	27·10	222·5	197·6
Iran	25·27	20·52	190·4	155·0
Saudi Arabia	19·26	12·11	142·9	89·9
Mexico	8·39	8·07	58·7	56·4
Kuwait	6·39	2·22	46·7	16·2
Indonesia (incl. New Guinea)	4·41	1·12	31·9	8·0
Roumania* ..	4·31	3·93	31·7	28·9
Iraq	3·53	4·83	26·4	36·2
Colombia ..	3·34	3·54	24·2	25·7
The Argentine	3·33	3·13	23·3	21·9
Trinidad ..	2·95	2·99	20·4	20·7
British Borneo	2·79	1·81	20·1	13·0
Peru	1·97	1·80	15·1	13·8
Egypt	1·90	1·34	13·2	9·4
Canada ..	1·64	1·02	12·4	7·7
Bahrein ..	1·49	1·29	10·9	9·4
Austria* ..	0·92	0·93	6·4	6·2
Germany ..	0·64	0·58	4·5	4·1
Hungary* ..	0·48	0·57	3·7	4·3
The Netherlands	0·50	0·21	3·4	1·5
Ecuador ..	0·35	0·32	2·7	2·4
India	0·26	0·26	1·9	1·9
Others	1·03	0·83	7·4	6·0
TOTAL ..	488·97	432·21	3573·2	3160·5

* Estimated.
† According to the specific gravity of the crude oil 1 metric ton varies from 6·7 to 7·5 barrels.

This increase of 13 per cent becomes even more important when compared with the 1947 increase over 1946 (10 per cent), and the average of the annual rises in world production during the period between the two world wars (6·9 per cent) and during the last war (3·9 per cent).

ESSO MAGAZINE

A new monthly, *Esso Magazine*, published by the Anglo-American Oil Co. Ltd., made it first appearance in June.

The first issue includes an article on the early days of the parent company, right back in the 1860s when John D. Rockefeller invested £800 in the building of a refinery at Cleveland, N.J.; an illustrated feature on the Berlin airlift; and a description of a visit to the film cartoon studios of G.B. Animation Ltd.

The National Supply Company of Venezuela, C.A., with headquarters in Caracas, has been formed to represent the Venezuelan interests of The National Supply Company and of the Oil Well Engineering Co. Ltd.

COLLIERY LUBRICANTS

In its report for the year 1948, the National Coal Board states that during the year a start was made with the scientific control of lubricants used in coal mines. "Before nationalization a few laboratories tested oils and greases as a matter of course. This is now being made general. Preliminary surveys reveal a wide difference of practice in the choice of lubricants for a given purpose, and also in rates of consumption. During the year, therefore, with the help of one of the leading oil companies, about a dozen of the Board's scientific staff were given special training in the use of lubricants. In 1949, with the help of another oil company, more staff are being trained."

AUTOTHERMIC PROCESS

A new process, which is likely to prove of importance to the gas industry has been developed in the research and development laboratories of Universal Oil Products Company.

The process, which has been named Autothermic Cracking, provides a convenient and economical means of meeting emergency peak load demands for gas which occur on exceptionally severe winter days.

Supplying sufficient gas to meet sudden emergency peak load demands for home heating, and at the same time maintaining interchangeability in burning characteristics in the supplementary gas, is the most formidable technological problem confronting gas companies.

Two alternative methods to meet such emergencies are: storage of gas close to central distribution points, or manufacture of gas from stored raw material. Each of these has its place in certain cases and both are being further investigated.

The Autothermic process falls in the second category. It is extremely flexible with respect to throughput, pressures of operation, and raw material. It is these characteristics, combined with quick starting and low capital cost, that make it particularly adapted to the job of meeting the unpredictable emergencies.

Autothermic cracking consists in reforming propane, naphtha, natural gasoline, or other volatile hydrocarbons in admixture with air to make supplementary gas approaching the normal supply in quality. By varying the proportions of air to hydrocarbon, gases of a wide range of calorific value can be produced.

The process has important potential value for the petro-chemical industry also, inasmuch as ethane can be similarly cracked to produce ethylene, the starting material for the production of alcohol, anti-freeze compounds, etc.

R. M. Deanesly, a U.O.P. research chemical engineer, started with the basic idea of conducting cracking reactions by admixing air with the charge stock rather than by external heating, and has developed techniques resulting in a compact, low cost gasification process of exceptional simplicity, in which dilution of the gas with nitrogen is reduced to a minimum, thus greatly improving the quality of the gas.

The mechanism of the process consists of preheating separately the air and hydrocarbon streams, mixing while hot, and reacting in a small insulated vessel. The hydrocarbon-air mixture is rapidly converted to reformed gas and nitrogen. The hot gases leaving the reactor are cooled by heat exchange. Heat losses are almost negligible, the overall thermal efficiency of the process being better than 98 per cent.

Essentially, the same procedure can be applied to the production of ethylene as has been described for gas making. The preferred raw material for either operation depends on the location of the plant, and other factors.

The Autothermic process has been tested and proved in pilot plant operations producing 1000–2000 cu. ft. of gas per hour, and thorough burner tests on the gas have been conducted by engineers of large gas companies.

Propane-air plants now being used by gas companies to produce peak load gas can be readily converted to the Autothermic process.

RUSSIAN LITERATURE

English translations of the Russian *Journal of General Chemistry* will be available on an annual subscription ($95) basis from the Consultants Bureau, 153 West 33rd Street, New York 1, N.Y., U.S.A. Delivery of the twelve monthly issues of Vol. 18 (1948) is promised by January 1, 1950, and of the 1949 volume by June 1, 1950.

METRIC OIL MEASUREMENT TABLES

Conference in Brussels

The American Society for Testing Materials and the Institute of Petroleum have agreed, as part of their co-operative work in the sphere of Oil Measurement Standardization, to compile and publish under their joint names a book of Oil Measurement Tables. These tables, which will embrace the American, British, and Metric systems, will later be put forward for international acceptance, and it is confidently hoped that they will win wide approval.

It was thought that so far as concerns the production of tables dealing with the metric system, this object would be best achieved by the prior approval of their basic data by the standardizing authorities of European countries using the metric system. Accordingly, preliminary discussions took place in Paris last year between A.S.T.M. and I.P. delegates on the one hand and representatives of petroleum and standardizing authorities in Belgium, France, and Holland on the other. The outcome of these discussions was that it was agreed that details of the basis and method of computation of each metric table, together with specimen pages of certain tables and skeleton specimen pages of the remainder, would be prepared and, if necessary, a further meeting arranged.

The prepared basic data and formulae for the metric tables were then agreed by the A.S.T.M. and I.P. and the requested material was prepared and made available to a large number of countries using the metric system. Arrangements were then made through the good offices of La Société Belge pour l'Étude du Pétrole for a conference to discuss this material to be held in Brussels on June 8 and 9, 1949.

Representatives of standardizing authorities and of the petroleum industry in Belgium, Denmark, France, West Germany, Holland, Italy, Norway, Spain, Sweden, and Switzerland, were present at the conference, in addition to observers from the International Standards Organization, Argentine, Mexico and Venezuela as well as delegates from the A.S.T.M. and a strong contingent from the I.P.

On June 8, two papers, summaries of which had been translated into French and made available in advance of the conference were presented to the assembly. During the morning session, Mr H. Hyams, chairman of I.P. Committee on Measurement and Sampling, read his paper "Towards International Standardization in Oil Measurement—the Contribution of the Institute of Petroleum". This was followed by a statement by Mr L. C. Burroughs, chairman of A.S.T.M. D.2—Division on Measurement and Sampling, on the work of the A.S.T.M. on Oil Measurement Standardization. A general discussion of Mr Hyams's paper then took place. The afternoon session consisted of the presentation by Mr H. Hyams of a paper, "A Manual of Oil Measurement Tables—The Co-operative Work of the A.S.T.M. and the I.P." by H. Hyams and H. R. Holmes, chairman of I.P. Panel on Units of Measurement, Calculations, and Tables, followed by a general discussion of the paper.

The morning of June 9 was devoted to detailed discussion of the basic data and information on metric oil measurement tables which had been prepared in response to the requests made in Paris in 1948. The discussion concluded with a series of questions on principles on which the views of the representatives of metric countries were sought.

Results of the Conference

After the discussion of the basic data and formulae the following points were agreed by the Conference:

1. The volume and density reduction tables are to be based on the data contained in the U.S. National Bureau of Standards "Technologic Paper No. 77" and the Natural Gasoline Association of America "Standard No. 2142". The introductions to these tables will stress this fact.

2. The weight volume tables are to be constructed on the basis of weights in air.

3. For the computation of tables which refer to metric weights, the density of air is to be taken as 0·001222 g per millilitre, and the density of brass as 8·1 g per millilitre.

4. The thermal expansion of glass apparatus used to determine densities will be accounted for by means of a first order coefficient of 0·000023 per degree Centigrade and a second order coefficient of 0·00000002 per degree Centigrade.

5. The standard reference temperature for oil volumes in the metric system is to be 15° C.

6. In all tables which contain columns referring to "Density at 15° C" these columns are to be headed with the symbol "D" and each page of such tables is to contain the formula:

$$D = \frac{\textit{Mass of any given weight of oil at } 15^\circ C}{\textit{Mass of equal quantity of water at } 4^\circ C}$$

7. The introductions to the metric weight volume tables are each to contain a short table giving the correction to be applied to weights in air to obtain weights *in vacuo*.

8. The tables are to be constructed to give an accuracy of 1 part in 10,000. The metric tables will be constructed strictly on the definition of the litre, but the above order of accuracy will mean the elimination of the difference between the litre and the cubic decimetre.

9. The tables which refer to metric units are to be printed so that the comma denotes the decimal point and the period marks off the thousands.

10. The tables which refer to metric units will be 15 in number, their reference numbers and titles being:

Table 4. Reduction of observed density to density at 15° C.

Table 7. Volume at 15° C occupied by unit volume at indicated temperature against density at 15° C.

Table 10. Abridged volume correction factors based on ranges of density at 15° C.

Table 11. Degrees A.P.I. at 60° F to specific gravity at 60° F and density at 15° C.

Table 12. Specific gravity at 60° F to density at 15° C and degrees A.P.I. at 60° F.

Table 13. Density at 15° C to degrees A.P.I. at 60° F and specific gravity at 60° F.

Table 17. Kilograms per litre at 15° C and litres at 15° C per metric ton, against density at 15° C.

Table 30. Short tons and long tons per 1000 litres at 15° C, against density at 15° C.

Table 31. Litres at 15° C per short ton and per long ton, against A.P.I. at 60° F.

Table 32. Litres at 15° C per short ton and per long ton, against specific gravity at 60° F.

Table 33. U.S. gallons at 60° F, barrels at 60° F, and Imperial gallons at 60° F per metric ton, against density at 15° C.

Table 34. Metric tons per 1000 U.S. gallons at 60° F and per U.S. barrel at 60° F against A.P.I. at 60° F.

Table 35. Metric tons per 1000 Imperial gallons at 60° F against specific gravity at 60° F.

Table 36*a* Litres at 15° C per U.S. gallon at 60° F against degrees A.P.I. at 60° F.

(*b*) Litres at 15° C per U.S. barrel at 60° F against degrees A.P.I. at 60° F.

(*c*) Litres at 15° C per U.S. gallon at 60° F against specific gravity at 60° F.

(*d*) Litres at 15° C per U.S. barrel at 60° F against specific gravity at 60° F.

(*e*) Litres at 15° C per Imperial gallon at 60° F against specific gravity at 60° F.

Table 37. U.S. gallons at 60° F and Imperial gallons at 60° F per litre at 15° C, and barrels at 60° F per 1000 litres at 15° C, against density at 15° C.

CONCLUSION

The Brussels Conference has cleared up all outstanding questions relating to the production of metric oil measurement tables. There was a clear indication from those who attended the conference that such metric tables were badly needed and that the proposed A.S.T.M./I.P. work was warmly welcomed.

The recent meeting in London between A.S.T.M. and I.P. representatives also finally cleared up all outstanding points relating to the proposed joint book of Oil Measurement Tables.

Once the formal approval of A.S.T.M. D-2, Division on Measurement and Sampling has been obtained, the work of computation and production can proceed.

Rubber in Bituminous Road Constructions and some other applications of rubber containing bitumen is the title of a new booklet written by F. T. Bokma. (Communication No. 96 Rubber Stitching, P.O. Box 66, Delft, Holland.) The booklet gives details of experimental road-surfaces in Java, illustrated by photos and diagrams, and of investigations in Amsterdam and Rotterdam.

S.O.N.J. PRODUCTION

Net crude oil production of Standard Oil Co. (New Jersey) and its affiliates for the year 1948 averaged 1,075,000 brl/day, a record and 8 per cent higher than in 1947. The U.S.A. portion of this output was 428,000 brl/day average, and foreign production 647,000 brl/day. Purchases by American affiliates from independent producers averaged 925,000 brl/day, with sales of 605,000 brl/day to other refineries, while purchases by foreign affiliates amounted to 28,000 brl/day.

Expenditure on oil exploration and development during the year was $374,000,000, and more wells were drilled than in any previous year. Additions to proved reserves in America virtually equalled the year's production, while added reserves abroad substantially exceeded production.

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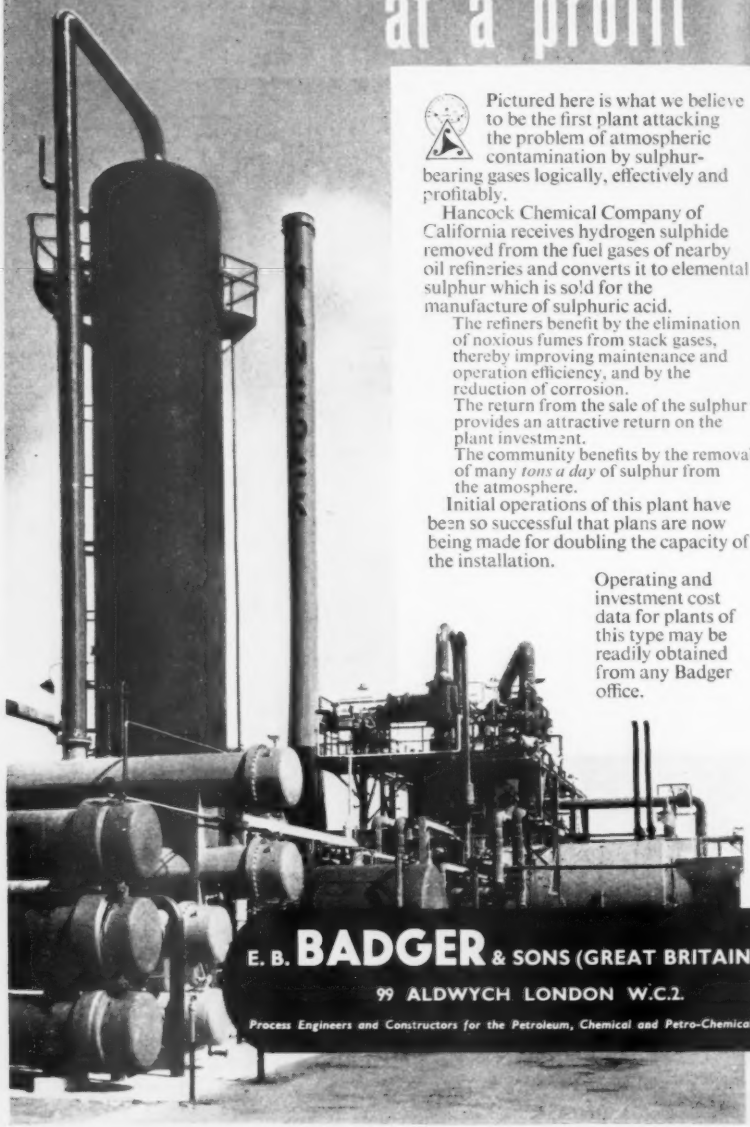

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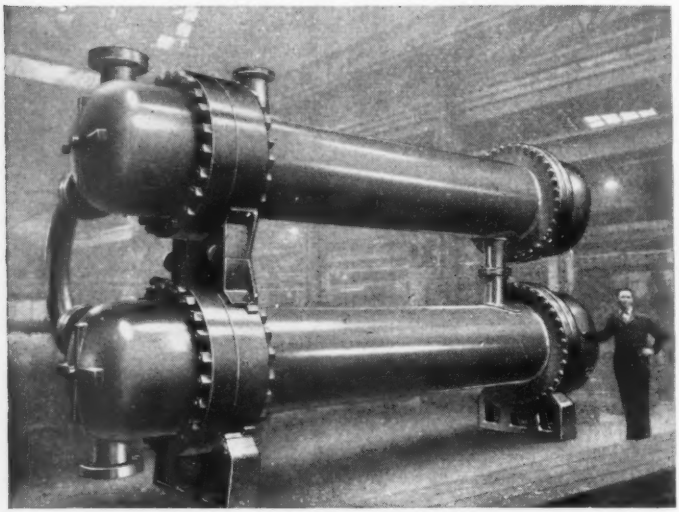

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